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AUTHOR	Stokes, Suzanne P.
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ABSTRACT

Undergraduate college students enrolled in courses that incorporated Web-based modules were surveyed to assess their satisfaction with learning in a digital instructional environment with the goal of identifying possible predictors of satisfaction according to temperament, preferred learning styles, and the demographic characteristics of gender, age, grade point average, major according to academic division, experience with using the World Wide Web, and previous courses taken that incorporated Web-based lessons. Temperament classifications were guardian, artisan, idealist, and rational, and were determined through the Keirsey Temperament Sorter II. Preferred learning style categories were active/reflective, sensory/intuitive, visual/verbal, and sequential/global, based on Felder and Solomon's Index of Learning Styles. Satisfaction was measured on a 16-item satisfaction scale developed by the researcher. Forward selection logistic regression analysis of the data revealed that the level of experience with using the World Wide Web and gender were significant predictors of student satisfaction when all other variables were controlled. Students who described themselves as being at ease with using the Web were more likely than less experienced users to be satisfied with the digital learning environment. Females were more likely to be satisfied with digital learning than were males. Considered important from the research findings is the absence of predictors of satisfaction, with the view that students considering enrolling in courses that incorporate digital learning, but who may be reluctant to register because of perceived mismatches between personal traits and the digital environment should be reassured that the environment is not restrictive in terms of temperament, preferred learning styles, age, grade point average, university classification, major, or previous digital learning experience. The developed questionnaire is attached. (Contains 5 tables and 49 references.) (Author/SLD)

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TEMPERAMENT, LEARNING STYLES, AND DEMOGRAPHIC PREDICTORS OF COLLEGE STUDENT SATISFACTION IN A DIGITAL LEARNING ENVIRONMENT

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Suzanne P. Stokes
Troy State University
College of Health and Human Services
4 Collegeview
Troy, AL 36082
334-670-3741, FAX 334-670-3744
sstokes@troyst.edu

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Abstract

Undergraduate college students enrolled in courses that incorporated Web-based modules were surveyed to assess their satisfaction with learning in a digital instructional environment, with the goal of identifying possible predictors of satisfaction according to temperament, preferred learning styles, and the demographic characteristics of gender, age, grade point average, major according to academic division, experience with using the World Wide Web, and previous courses taken that incorporated Web-based lessons. Temperament classifications were guardian, artisan, idealist, and rational, and were determined through the Keirsey Temperament Sorter II. Preferred learning styles categories were active/reflective, sensory/intuitive, visual/verbal, and sequential/global, based on Felder and Solomon's Index of Learning Styles. Satisfaction was measured on a 16-item satisfaction scale developed by the researcher. Forward selection logistic regression analysis of the data revealed that the level of experience with using the World Wide Web and gender were significant predictors of student satisfaction when all other variables were controlled. Students who described themselves as being at ease with using the World Wide Web were more likely than less experienced users to be satisfied with the digital learning environment; females were more likely to be satisfied with digital learning than were males. Considered important from the research findings is the absence of predictors of satisfaction, with the view that students considering enrolling in courses that incorporate digital learning, but who may be reluctant to register because of perceived mismatches between personal traits and the digital environment, should be reassured that the environment is not restrictive in terms of temperament, preferred learning styles, age, grade point average, university classification, major, or previous digital learning experiences.

Temperament, Learning Styles, and Demographic Predictors of College Student Satisfaction in a Digital Learning Environment

The merging of technology, connectivity, content, and people creates a digital learning environment that advances education (CEO Forum on Education and Technology, 2000). This learning environment is appropriate in postsecondary education where the focus is on adult students (Hiltz, 1997). Because it is compatible with different media mixes, digital learning is used in conjunction with a face-to-face setting characterized by variations ranging from enriching traditional courses with technology-based modules, to supplementing distance learning courses with occasional face-to-face sessions. Its inherent versatility is conducive for designing instruction that serves on-campus students as well as students who choose a distance learning option.

Distance learning is an increasingly important component of higher education (National Center for Education Statistics [NCES], 1997, 1999a, 1999b). NCES data from 2-year and 4-year postsecondary education institutions indicate the digital learning environment in higher education is expanding not only in the number of institutions, but also for enrollments, particularly at the undergraduate level. Although the institutions surveyed used various types of technology as the primary mode of instructional delivery for distance education courses, more institutions used asynchronous Internet instruction than other forms of technology.

The potential of a digital learning environment in higher education is consistent with Knowles's (1970) view that the mission of adult education is "to develop a total environment conducive to human growth and fulfillment – an educative community" (p. 34). Tapscott (1998) described learning based on digital media as interactive learning that is learner centered with a focus on the construction of knowledge, as compared to the broadcast learning that is teacher

centered and focuses on instruction. The emphasis on self-directed and problem-centered learning, fundamental in Knowles's (1970) theory of androgogy, is consistent with the constructivist model that is particularly appropriate for teaching and learning using emerging technologies (Lunenberg, 1998). However, adult learners present a wide range of individual differences including differences in orientation to learning and readiness to learn (Knowles, 1970, 1984; Sarasin, 1999), and no assumptions should be made about adults' preferences for instructional delivery simply because they are adults (Bullen, 1997).

Keirsey (1998) categorized four fundamental, innate differences observed in human behavior as temperaments. An individual's temperament influences adaptation to situations (Berens, 1998). The four kinds of character identified by Plato and used by Keirsey in explaining his temperament theory are artisan, guardian, idealist, and rational (Keirsey, 1998). Golay (1982) and Berens (1998) related Keirsey's temperament theory to general learning approaches. Limited research is available on the application of temperament-based learning styles, although Horton and Oakland (1997), in a study investigating relationships between achievement and instruction designed according to temperament-based learning styles, found no relationship between the two. These researchers stress that temperament is only one of several attributes that affect achievement and attitude. Other considerations include the type of instruction, learning theory principles, learning style, age, and stage of development.

Learning style is a factor in the success of students in higher education (Sarasin, 1998). Learning styles have been categorized in many different ways with no single model commonly accepted, although most are categorized according to environmental preferences, sensory modalities, personality types, or cognitive styles (Leaver, 1997). Regardless of the classification scheme, more learning occurs when instructional strategies are matched with students' learning

styles. Likewise, when students are aware of their learning style preferences, techniques can be used to maximize learning, particularly when the instructional styles differ from preferences. Felder and Solomon (Felder, 1996) developed the Index of Learning Styles based on the Felder-Silverman model in which college students are classified as sensing or intuitive learners, visual or verbal learners, active or reflective learners, and sequential or global learners. Felder, as do others (i.e., Kolb, 1984; Sarasin, 1998), promotes the use of multiple instructional approaches to match students' various learning styles as a means to improve students' learning, satisfaction with instruction, and self-efficacy.

As the learning environment shifts from traditional to distance delivery in higher education, the issue of satisfaction with learning emerges (Long, Tricker, Rangecroft, & Gilroy, 2000). Determining satisfaction gives universities information to react appropriately through avenues such as improving students' experiences or helping students manage their expectations. Studies addressing student satisfaction with distance learning include both Web-based and video-based delivery; data from these studies suggest that satisfaction with learning in a technology-based environment is comparable to that of learning in a traditional classroom environment. Phillips and Peters (1999) reported positive satisfaction by students enrolled in video-based distance learning courses, noting no difference in the satisfaction levels between urban and rural students. Inman and Kerwin (1999) recognized that distance learning technology is not best suited for every student, yet in assessing satisfaction in video-based telecourses, found that students as a whole are clearly satisfied. Wright (1999) found a greater degree of student satisfaction between students in Web-based courses and those enrolled in the same course in a traditional classroom environment. Reviews of research reports, summaries, and papers on technology for distance education compiled by Russell (http://teleeducation.nb.ca/

nosignificantdifference/, http://teleeducation.nb.ca/significantdifference/) provide a wealth of information on studies comparing distance learning media. However, little research is available that examines learner attributes that are predictive of satisfaction of the college student with the digital learning environment.

Identifying learner characteristics is basic to studying the use of instructional technology (Gibson, 1998). Although institutions benefit by designing programs that reflect their student bodies, students benefit through self-identification of individual characteristics affecting learning and, in turn, satisfaction with the educational experience. Nunn (1994) noted a pattern of contrasts between younger and older learners in the instructional setting, resulting in a need to identify alternatives for the learning environment. Maki, Maki, Patterson, and Whittaker (2000; as cited in Carr, 2000) reported evidence that average-ability students tend to benefit from Internet courses but that weaker students do not, and that attrition is greater among weaker students. An outcome of their research is interest in the development of a tool to determine the most appropriate mode of instruction for students based on individual differences, particularly for students who express an interest in Web-based courses.

With the clear emergence of a digital learning environment in higher education and the call for research regarding factors that will impact technology in teaching and learning, as well as the realization that the environment may be appropriate for some students but not for others, an investigation of student characteristics that can serve as predictive indicators of satisfaction was warranted. This study looked at variables that may predict satisfaction with digital learning for the adult college student who participates in instruction through Web-based instructional modules. The variables considered were temperament, learning styles preferences, and selected demographic characteristics. These factors are not alone in influencing learners' acceptance of

the digital learning environment, but are supplementary to the seamless integration of technology, teaching, and learning, along with the potential of the environment to advance learning through the development of strategies for student success.

The purpose of this study was to identify predictors of student satisfaction with the digital learning environment. Specifically, this study focused on the following factors as possible predictors:

1. Temperament: artisan, guardian, idealist, rational;
2. Learning styles: sensory/intuitive (perception), visual/verbal (input), active/reflective (processing), sequential/global (understanding);
3. Demographics: gender, age, university classification, grade point average, major, experience with the World Wide Web, and experience with Web-based courses.

The research questions posed by this study were:

1. Are temperament, learning styles, and demographic characteristics of college students predictors of satisfaction in a digital learning environment?
2. Do students who have like temperaments possess common demographic characteristics?
3. Do students who have like learning styles possess common demographic characteristics?

Assumptions associated with this research were that all students who volunteered to participate would have the skills necessary to complete the Web-based survey, that all would understand the survey instrument, that each would be honest in recording responses, and that each would submit only one survey. Further assumptions were that the student participants were

representative of learners at the institution, and that they were representative of the student population involved in a digital learning environment at the postsecondary level.

A number of limitations were associated with this research. One limitation was that only students from a single institution in the southeast region of the United States were included. In addition, measuring satisfaction levels of students in high-quality courses such as those offered by the institution in which the research was performed limited generalizability to the total population of college students in digital learning environments. A third limitation was that all students surveyed were enrolled in credit courses offered by the Department of Instructional Technology at The University of Alabama, and students chose to become involved with digital technology upon enrollment. A further limitation was that all survey data were collected via Web-based forms, which exposed the research to possible violation of the assumptions named above. Because the data were collected at only one point in time for each participant, extreme indicators may have emerged; however, these will generally not show up in an aggregate view of the data, if they indeed exist.

Method

Research Population and Sample

College students who are exposed to a digital learning environment through the use of Web-based instructional modules were the target population for this research. The sample was undergraduate students enrolled in two educational computer technology (BCT) courses that use Web-based instructional modules during the Spring, 2001, semester at The University of Alabama. This sample was used because of convenience; however, presumed similarities between the population and the sample included a mix of gender, age, university classification, grade point average, experience with the World Wide Web and Web-based courses,

temperament, learning styles, and representation from a variety of academic majors. All students enrolled in multiple sections of these two courses during the targeted semester were offered the opportunity to participate in the research project. All interactions with the subjects were approved by the Institutional Review Board for the Protection of Human Subjects (IRB) at The University of Alabama, and were consistent with IRB policies. Anonymity of participants was protected and all information was treated confidentially.

Research Design

The research design included a descriptive aspect in which the characteristics of the subjects at a single point in time were described. Descriptive items in this study were temperament, learning styles, satisfaction, and demographic characteristics as previously noted. Also included was a correlational research design in which relationships among the variables were investigated and possible predictors of student satisfaction were explored. The dependent variable in this research was student satisfaction with learning in a digital environment in which instructional modules are presented through the World Wide Web. Independent variables were temperament, learning styles, and demographic characteristics.

Data Collection

All data were collected through Web-based forms. The Keirsey Temperament Sorter II (KTSII) (Keirsey, 1998, 2001) is an online personality questionnaire comprised of 70 multiple-choice questions. The KTSII identifies four temperament types: guardian, artisan, idealist, and rational. The Index of Learning Styles (ILS) consists of 44 short sentences with a choice between two endings for each sentence. Results are transposed as scores on four dichotomous scales: sensory/intuitive, visual/verbal, active/reflective, and sequential/global. After completing and electronically submitting the KTSII and the ILS, each participant received descriptions of his or

her temperament and learning styles preference, respectively. Instructions to students were to record the results for use in later course activities. The KTSII and the ILS lacked consistent reliability and validity data. However, considering the results as they contribute to the body of knowledge being constructed through this research and other published research, the use of the chosen instruments was justified.

The questionnaire to determine student satisfaction was developed by the researcher and is referred to as the Satisfaction Survey (see Student Satisfaction Questionnaire, Appendix A). Questionnaire items were based on insights gained from the review of the literature, particularly from Biner, Dean, and Mellinger (1994) and Wernet, Olliges, and Delicath. (2000), and input from a team of instructional technology experts comprising professors in the Instructional Technology program at The University of Alabama. These professors studied the tool and established face validity of the questionnaire. The reliability coefficient for the scale's internal reliability with the research sample was .83, using Cronbach's alpha method. This questionnaire also was used to collect demographic data and the temperament and learning styles results.

Data Analysis

Data obtained through the Satisfaction Survey were recorded as a mix of interval, ordinal, and nominal data. Descriptive statistics were used to report gender, age, university classification, grade point average range, experience with using the World Wide Web and Web-based courses, major according to academic division, learning style categories, and temperament classification of the sample. Responses to each statement related to satisfaction with the digital learning environment were reported by using frequencies and percentages for each indicator level. The overall satisfaction score for each participant was obtained by adding the numeric values of the 16 statements; the range of possible scores was 16, indicating a low level of satisfaction, to 80,

indicating the highest level of satisfaction. The degree of satisfaction was then recoded dichotomously as satisfied or unsatisfied, with the median score of 70 as the determinant for the categories; scores up to and including 68 were categorized as unsatisfied, whereas scores from 70 through 80 were categorized as satisfied. There was no score of 69.

Forward selection logistic regression was used to predict satisfaction based on the variables analyzed. Each predictor variable (temperament, preferred learning styles, and demographic characteristics) was correlated with the criterion, student satisfaction, with the rating of satisfied or unsatisfied with the digital learning environment. Two levels of experience were considered in the analysis; these were less experienced, comprising the novice and intermediate users, and more experienced, comprising the proficient users. Logistic regression was chosen because of its usefulness when the dependent variable is dichotomous and when the predictors are expressed as continuous or categorical data (Morgan & Griego, 1998). In this research project, the regression equation indicated whether or not there was a significant effect from the predictor variables on satisfaction, and offered the probability of a correct prediction of student satisfaction for the set of predictor variables. Variables that emerged as predictors of satisfaction were also compared to individual satisfaction item responses to identify possible relationships.

Results

The Satisfaction Survey was completed by 145 students, which represented 87% of the students enrolled in the courses in which the invitation to participate was extended. The sample was nearly evenly divided according to gender, with 52% female (N=76) and 48% male (N=69) participants. Nearly all (91%) of the participants were between 19 and 23 years old, with an average age of 21.7 years. Slightly more than half were classified as seniors and one fourth were

college juniors. Most of the participants' grade point averages were between 2.5 and 3.49. The participants were representative of several academic divisions, with the College of Commerce and Business Administration and the College of Education having the most representation with 28% each, followed by the College of Arts and Sciences with 20%, and the College of Communication and Information Sciences with 17%. Fewer students represented other academic divisions.

Participants' experience with the World Wide Web was categorized as novice, intermediate, or proficient on the survey. The novice experience level was defined as not familiar with using the World Wide Web; 2% described themselves as novice users. The intermediate experience level was defined as being familiar with using the World Wide Web; 42% of the participants indicated their experience at the intermediate level. The proficient level was defined as being at ease with using the World Wide Web; the majority of participants (56%) described themselves as proficient in terms of experience with using the World Wide Web. After combining the novice level with the intermediate level and recoding to two levels of experience, 44% were categorized as less experienced, while the proficient, or more experienced group, remained at 56%. Participants reported the number of courses previously taken that used Web-based lessons. One third of the participants indicated they had taken two previous courses, yet nearly one fourth of the sample reported no experience with courses incorporating Web-based lessons.

Results of the Keirsey Temperament Sorter II indicated that 71% of the participants were classified as guardian, 19% as idealist, 6% as artisan, and 3% as rational. Results of the Index of Learning Styles indicated that nearly three fourths (73%) of the participants processed information actively rather than reflectively. A similar number (76%) reported that they

perceived information through sensing rather than intuitively. Over 80% of the participants preferred to receive sensory information visually rather than verbally. Progression toward understanding was identified as global by 64% of the students, but sequential by 36% of the sample.

Participants were asked to respond to 14 statements according to how often each statement described individual views (often, sometimes, or seldom). Two additional statements were answered by yes or no. Responses were tallied according to a numeric value, with the least possible score being 16 and representing a low level of satisfaction. The maximum score was 80, representing a high level of satisfaction. The range of satisfaction scores for the sample was from 30 to 80, with the mean score for the group at 67.4 and the median score at 70. Individual Satisfaction Survey statements scaled from low to high agreement as measures of satisfaction were compared with the overall high or low satisfaction levels. The data indicate significant differences between the individual item scores for the more satisfied and the less satisfied participants for all of the statements, with the mean scores for the more satisfied group consistently higher than the mean scores for the less satisfied group (see Table 1).

Research Question One

Are temperament, learning styles, and demographic characteristics of college students predictors of satisfaction in a digital learning environment?

Forward selection logistic regression analysis of the data revealed that the level of experience with using the World Wide Web and gender were significant predictors of student satisfaction when all other variables were controlled (see Table 2). According to the odds ratios, females are more likely to be satisfied with a digital learning environment than are males, and the more experienced World Wide Web users are more likely to be satisfied with the digital

learning environment than are the less experienced users. The model correctly predicted satisfaction in 68.8% of cases. Results from a t-test comparison of the responses of the less experienced users and the more experienced users to specific satisfaction items indicated that the impact of experience was significant for items 1, 2, 4, 5, 6, 7, 10, 11, 14, 15, and 16 (see Table 3). The more experienced users group, consisting of participants who described themselves as being at ease using the World Wide Web, indicated a higher satisfaction level through each of these statements. Results from a t-test comparison of the responses according to gender to individual satisfaction items indicated that gender was significant for items 6, 11, 12, 13, and 14 (see Table 4). Females presented a higher satisfaction rating for each of these statements.

The two predictor groups, experience and gender, were compared to determine whether males and females differed in terms of experience. No significant difference (p=.626) in the two experience levels between males and females was observed.

The number of previous courses that incorporated Web-based lessons taken by students was not a predictor of satisfaction according to the regression model, although the relationship was significant in step one of the process. Further analysis of the relationship between these two variables revealed a significant difference in the mean number of courses taken by the less experienced users and the more experienced users (see Table 5).

Research Question Two

Do students who have like temperaments possess common demographic characteristics?

Relationships among temperament and demographic characteristics were analyzed by using Chi-square for variables expressed as categorical data; one-way analysis of variance (ANOVA) was used to investigate the relationship between temperament and age. No significant

relationships were noted among temperament and the demographic characteristics surveyed.

Research Question Three

Do students who have like learning styles possess common demographic characteristics?

Relationships among preferred learning styles and demographic characteristics were analyzed by using Chi-square for variables expressed as categorical data; however, the t-test for independent means was used to investigate the relationship between preferred learning styles and age. Only one relationship was significant in the comparison of learning styles with demographic data; participants who preferred visual learning to verbal learning had a significantly lower mean age (see Figure 1). An additional t-test examining the preferred learning styles in only the 19-26 year-old age range, which made up 95% of the sample, failed to identify a relationship between any of the learning style preferences and age.

Additional Analysis

Comparisons of preferred learning styles and temperament were conducted by using Chi-square to determine whether students with a common learning style shared a similar temperament. No significant relationships were noted between the temperaments of the participants and their preferred learning styles.

Discussion

The students who participated in the study displayed a mix of common and diverse demographic characteristics. Most of the participants reported the guardian temperament classification, followed by the idealist category. These temperament results were similar to those published by Keirsey (2000) at the time of this research, adding strength to the assumption that the study participants were representative of the larger student population. However, the data provided by Keirsey did not differentiate the ages or the occupations of the participants, so this

inference is unsubstantiated. Most of the participants' learning style preferences were similar to those reported by Montgomery (1995), who also used the ILS with a group of sophomore level students in an engineering course, lending credibility to the assumption that the study participants were representative of the population of college students. Although the numbers for the current study and the Montgomery research were remarkably similar, neither set of results is sufficient to present conclusive evidence regarding the learning styles of college students. However, Schroeder (1993) noted that the majority of entering college students preferred a sensory learning style to an intuitive style. Furthermore, Schroeder suggested that educational research indicates that the population of college students is likely to increase in the number of sensory learners as the college student population becomes more diverse.

The number of previous courses taken that incorporated Web-based lessons varied widely, ranging from none in 23% of the participants, to four or more for 11% of those surveyed. Wegner, Holloway, and Garton (1999) expressed concern in their research about whether or not the novelty of the experience affected students' positive feelings with an Internet-based class. This effect was not apparent in the present study where 56% of the participants with no previous course experience indicated a lower level of satisfaction, with the remaining 44% indicating a higher level.

The satisfaction levels, according to the survey responses, were generally high with a mean score of 67 and a median score of 70 on a scale of 16 to 80. However, the high satisfaction levels of students in quality courses such as those offered by the institution in which the research was performed were not unexpected. Survey items that were most indicative of a high satisfaction level were the willingness to take a Web-based course again and the willingness to recommend a Web-based course to a friend. These findings are congruent with those reported by

St. Pierre and Olsen (1991) who supported the view that the best measure of student satisfaction is the willingness of the student to take another similar course.

Items with a high level of satisfaction by at least 80% of the participants were Internet access, increased flexibility in daily activities by taking a Web-based class, and readily available Internet resources for class work. Shaw and Pieter (2000) and Hiltz (1997) noted that satisfaction levels diminished as problems with accessing online materials increased; this observation is consistent with the findings from this research in which the students with the highest overall satisfaction score had the fewest low scores on the satisfaction item addressing Internet access.

At least two thirds of the students expressed high satisfaction with Web-based courses, which they felt provided skills that could be used in other classes, success in completing Web-based lessons, preparation for using technology in the professional world, substantial contact with the teacher, little feeling of isolation arising from learning that emphasizes Web-based lessons, and positive experiences in communicating with other students through email. Items that fell lower on the satisfaction scale were, in order from more satisfied to less satisfied, having technology knowledge sufficient for learning in a Web-based environment, and feeling that working in a Web instructional environment enables a more active role in learning. Although 92% of the participants specified that they would be willing to take a Web-based course again, only 41% expressed a preference for more classes to be offered through Internet delivery, and 34% indicated a preference for more of the course materials in face-to-face classes to be in a Web-based format.

The first research question examined temperament, preferred learning styles, and demographic data as possible predictors of college student satisfaction with the digital learning environment. The level of experience with using the World Wide Web emerged as a predictor of

student satisfaction when all other variables were controlled, with the more experienced participants indicating greater satisfaction with learning in a Web-based environment that those with less experience. Data were analyzed further to determine whether relationships existed between the level of experience in using the World Wide Web and specific items on the satisfaction questionnaire. Those with a higher level of experience reported significantly higher degrees of access to the Internet and locating Internet resources for course work, more success with completing Web-based lessons, fewer feelings of isolation from the university setting due to taking a course with emphasis on Web-based lessons, and a preference for taking more classes through Internet delivery. Other areas where the more experienced group reported significantly greater levels of satisfaction were in believing that working in a Web instructional environment enabled them to take a more active role in the learning process, in feeling that communication with other students through email has been a positive experience, in believing that the Web-based class provided them with skills that could be used in other courses, and in their willingness to take another Web-based course as well as to recommend a Web-based course to a friend.

Experience with using the World Wide Web did not emerge as a predictor of satisfaction in DeBourgh's (1999) study of graduate students in a mixed media distance learning program, nor was experience with technology-based learning related to positive attitudes in Westbrook's (1999) study of graduate students' attitudes toward Web-based learning. Although these studies both involved only graduate student samples, undergraduate students were included in a study by Wernet et al. (2000) of satisfaction with the WebCT Web-based course management software; experience with Web technology made no difference in satisfaction levels. It should be noted that the present study data categorized experience according to familiarity with and ease of using

the World Wide Web, descriptors that may have been different than those used in other research projects.

Gender also emerged as a predictor of student satisfaction when all other variables were controlled, with females tending to be more satisfied with the digital learning environment. Gender was an unexpected predictor of satisfaction; data were analyzed further to determine whether relationships existed between gender and specific items on the satisfaction questionnaire. Female participants, as a whole, indicated that they seldom felt isolated from the university setting due to taking a class that places emphasis on learning through Web-based lessons, whereas males tended to feel more isolated in the setting. As compared to the male participants, females indicated a greater level of positive experiences in communicating with other students through email, found the online tutorials to be more useful in helping them to understand the course materials, had more positive feelings about Web-based classes providing skills that could be used in other courses, and had a stronger belief that the format was preparing them for technology use in their professions.

The findings related to gender were similar to those of Ory, Bullock, and Burnaska. (1997) who found that females used the computer more often for communication than did males; these findings are in contrast to results from Blum's (1999) study of gender differences of student postings on an open discussion forum, which suggested that barriers to communication in an online environment exist more for females than for males. Although Ory et al. (1997) noted that males used the computer more for locating course resources, there was no significant difference between male and female use of computers for locating resources in the present study. The study findings related to gender also differ from results reported by Arbaugh (2000) and Allen (1995), in which no differences between male and female satisfaction levels were found.

Temperament did not emerge as a predictor of satisfaction in the digital learning environment. Little has been published in the education literature about temperament as it relates to learning. However, Kreber (1998) noted that extrovert-intuitive psychological tendencies, found in idealist and rational temperaments, were predictors for self-directed learning in a group of undergraduate students. Conversely, Summers, Anderson, Hines, Gelder, and Dean (1996) found no significant relationship between satisfaction with instruction in telecourses and students with an extroverted personality, characteristic of idealist and rational temperaments. The nature of Web-based courses calls upon students to display self-directed learning traits but this was not a variable in the present study. Even so, the idealist and rational temperaments combined were seen in 22% of study participants, but no relationships among temperaments and satisfaction with digital learning were apparent.

Learning style as a predictor of satisfaction was not evident. This finding is consistent with that of Gunawardena and Boverie (1992) in a study of graduate students involved in computer-mediated instruction. Larsen (1992) also observed no relationship between adult learners' preferred learning styles and satisfaction with interactive video instruction, but recognized that the flexibility offered by the instructional method accommodated learners with different styles since the instruction was shaped by the learner's individual needs.

Age did not emerge as a predictor of satisfaction. The lack of a significant difference in the ages of the participants and the overall satisfaction rating could be due to the large number of young participants (mean age = 21.7 years). Wernet et al. (2000) observed that older graduate students were less likely to choose additional technology-based courses, but that younger undergraduate students were more enthusiastic about using technology for learning. The research

participants in the current study were similar to the younger enthusiastic undergraduates of the preceding study.

The participants' educational levels, categorized according to the university classifications of freshman, sophomore, junior, senior, and graduate, were not related to satisfaction. Allen (1995) observed that students who were more educated tended to be more satisfied with technology-based courses, but the education variables considered were graduate and undergraduate students, whereas 99% of the students in the present study were undergraduates.

The second research question explored relationships between temperament and demographic characteristics. No relationships were noted between participants' temperaments and gender, age, university classification, grade point average, major by academic department, experience with using the World Wide Web, or taking previous courses that used Web-based lessons.

The third research question explored relationships between preferred learning styles and demographic characteristics. Each participant had previously taken the Index of Learning Styles (ILS) and was classified according to four preferred learning styles based upon responses to the ILS statements. Only one relationship was significant in the comparison of learning styles with demographic data; participants who preferred visual learning to verbal learning had a significantly lower mean age. No other relationships were noted between any of the four learning style categories and gender, age, university classification, grade point average, major by academic department, experience with using the World Wide Web, or taking previous courses that used Web-based lessons.

The significant relationship indicated by the data analysis of age and visual learners should be viewed carefully. An individual's style of information perception and processing is based upon the predisposition of the individual (Sarasin, 1999). As learners age, they develop strategies to adapt to different styles of information presentation while retaining their innate learning style preferences. Considering the narrow age range of the study participants in which 95% were in the 19 to 26 year age range, conclusions regarding this relationship would be unfounded without further investigation. A further analysis of the relationships between learning style preferences and age, but limited to the 19 to 26 year-olds, revealed no significant differences in learning styles according to age, even for the visual learners. Tapscott (1998) suggested that the generation of youth born between 1977 and 1997 possesses digital expertise greater than that of preceding generations, largely due to the younger generation's exposure to emerging technologies. Most of the study participants were born in this period; however, equal access to digital technologies has not been available for all individuals of this age (Gladieux & Swail, 1999; National Telecommunications and Information Administration, 1999).

An additional aspect of the visual learning style preference for information input is the link between visual learning and the graphical user interface of the World Wide Web. The World Wide Web requires skills for reading and writing visually in order to derive meaning from what is being communicated (Branton, 1999). Even so, the statistical absence of a relationship between visual learners and satisfaction with learning in a digital educational environment, and the presence of a relationship between visual learners and age as evidenced in this research present a question for further investigation.

The lack of a relationship between preferred learning styles and selected demographic characteristics differs from the findings of other researchers. Fox and Ronkowski (1997) and

Philbin, Meier, Huffman, and Boverie (1995) reported learning style differences according to gender; Fox and Ronkowski also noted learning style differences according to college major and university classification. However, a different learning style instrument was used for these studies, and conclusions regarding true similarities or differences in the studies' results would be flawed.

Preferred learning styles and temperaments were compared to determine whether students with a common learning style shared a similar temperament. No significant relationships were noted between the temperaments and the preferred learning styles of the participants.

Recommendations

Recommendations from this research include early identification of inexperienced users of the World Wide Web and subsequent intervention through basic skills development. A second recommendation would be to recognize the possibility that gender differences may influence satisfaction, yet no recommendations for acting upon the recognition can be made. A study of the social dynamics particular to the university environment likely would provide insights useful for understanding the role of gender in satisfaction with digital learning. The third recommendation relates not so much to the statistically significant findings of this research, but to the variables that did not emerge as predictors of satisfaction. Students considering enrolling in courses that incorporate digital learning, but who may be reluctant to register because of perceived mismatches between personal traits and the digital environment, should be reassured that the environment is not restrictive in terms of temperament, preferred learning styles, age, grade point average, university classification, major, or previous digital learning experiences. The final recommendation from this research is to continue studying the population of college students who are engaged in digital learning across all academic divisions and to extend the demographic

variables investigated. The identification of additional impacts upon satisfaction and dissatisfaction holds merit; examples of areas to consider are self-efficacy, attitudes toward self-directed learning, attrition, and individual elements that were addressed in the Satisfaction Survey used in this research project.

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Table 1

Results of t-Test for Differences Between Satisfaction Levels and Satisfaction Ratings for Each Survey Item (see Appendix A for Satisfaction Questionnaire)

	Less Satisfied n=68		More Satisfied n=77			
Survey Item	Mean	Std. Dev.	Mean	Std. Dev.	t (df=143)	Sig.
Q1	4.47	.89	4.95	.32	-4.403	.000
Q2	4.29	1.08	4.90	.45	-4.479	.000
Q3	3.76	1.38	4.64	.78	-4.748	.000
Q4	3.91	1.12	4.82	.58	-6.241	.000
Q5	3.65	1.31	4.64	.78	-5.597	.000
Q6	3.76	1.47	4.48	1.10	-3.352	.001
Q7	2.56	1.33	4.27	1.07	-8.580	.000
Q8	4.32	1.13	4.87	.50	-3.859	.000
Q9	2.79	1.25	3.81	1.35	-4.659	.000
Q10	3.03	1.01	4.35	1.00	-7.926	.000
Q11	3.68	1.23	4.74	.75	-6.377	.000
Q12	3.06	1.38	4.35	1.00	-6.511	.000
Q13	3.65	1.36	4.92	.51	-7.660	.000
Q14	3.71	1.37	4.69	.80	-5.342	.000
Q15	4.41	1.43	4.95	.46	-3.123	.002
Q16	4.41	1.43	5.00	.00	-3.618	.000

Table 2

Results of Logistic Regression of Student Satisfaction

Variable	β	S.E.	df	Sig.	Exp(β)
Gender	1.000	.363	1	.006	2.717
Experience	1.262	.364	1	.001	3.531
Constant	-2.090	.643	1	.001	.124

Table 3

Results of t-Test Comparing Levels of Experience and Satisfaction Items

	Less Experienced (n=64)		More Experienced (n=81)			
Item	Mean	Std. Dev.	Mean	Std. Dev.	t (df=143)	Sig.
Q1	4.47	.89	4.93	.38	-4.169	.000
Q2	4.34	1.07	4.83	.57	-3.491	.001
Q3	4.16	1.28	4.28	1.11	-0.644	.520
Q4	4.16	1.12	4.58	.82	-2.637	.009
Q5	3.59	1.32	4.63	.78	-5.886	.000
Q6	3.75	1.53	4.46	1.05	-3.289	.001
Q7	3.00	1.47	3.84	1.37	-3.544	.001
Q8	4.50	1.01	4.70	.78	-1.371	.173
Q9	3.16	1.35	3.47	1.42	-1.345	.181
Q10	3.47	1.22	3.94	1.14	-2.382	.019
Q11	4.00	1.28	4.43	.96	-2.317	.022
Q12	3.66	1.34	3.81	1.37	-0.700	.485
Q13	4.13	1.33	4.48	1.04	-1.815	.072
Q14	3.97	1.38	4.43	1.01	-2.332	.021
Q15	4.50	1.33	4.85	.76	-2.000	.047
Q16	4.50	1.33	4.90	.62	-2.397	.018

Table 4

Results of t-Test Comparing Gender and Satisfaction Items

	Male (n=69)		Female (n=76)			
Item	Mean	Std. Dev.	Mean	Std. Dev.	t (df=143)	Sig.
Q1	4.83	.57	4.63	.78	1.701	.091
Q2	4.59	.88	4.63	.85	-0.261	.795
Q3	4.13	1.31	4.32	1.06	-0.942	.348
Q4	4.36	1.00	4.42	.97	-0.359	.720
Q5	4.25	1.09	4.11	1.24	0.725	.470
Q6	3.84	1.51	4.42	1.07	-2.685	.008
Q7	3.43	1.45	3.50	1.50	-0.266	.791
Q8	4.57	.96	4.66	.83	-0.624	.534
Q9	3.55	1.41	3.13	1.36	1.822	.071
Q10	3.61	1.15	3.84	1.23	-1.174	.242
Q11	4.04	1.17	4.42	1.07	-2.027	.044
Q12	3.46	1.50	4.00	1.15	-2.424	.017
Q13	4.04	1.36	4.58	.94	-2.783	.006
Q14	3.87	1.35	4.55	.96	-3.539	.001
Q15	4.65	1.14	4.74	1.00	-0.478	.634
Q16	4.59	1.22	4.84	.78	-1.472	.143

Table 5

Results of t-Test for Differences Between Levels of Experience With Using the World Wide Web and Experience According to Number of Courses with Web-Based Lessons

	Less Experienced			More Experienced					
	n	Mean	Std. Dev.	n	Mean	Std. Dev.	t	df	Sig.
Number of Courses with Web-Based Lessons	64	1.27	1.07	81	1.99	1.33	-3.533	143	.001

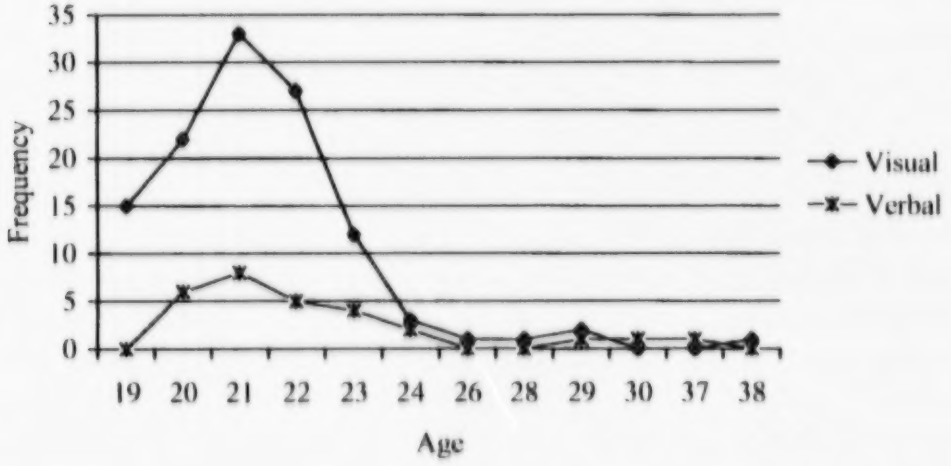

Figure 1. Distribution of participants' preferred visual/verbal learning styles according to age.

APPENDIX A
STUDENT SATISFACTION QUESTIONNAIRE

What is your temperament according to the Keirsey Temperament Survey II you completed last month?

O Guardian O Artisan O Idealist O Rational

What are your preferred learning styles according to the Index of Learning Styles you completed last month?

O Active O Sensing O Visual O Sequential
O Reflective O Intuitive O Verbal O Global

Gender: O male O female

Age: [ ]

Classification: O freshman O sophomore O junior O senior O graduate student

GPA range: O 3.5 and above O 3.0 to 3.49 O 2.5 to 2.99 O 2.0 to 2.49
O 1.99 and below

Major by college:

O College of Arts and Sciences
O Culverhouse College of Commerce and Business Administration
O College of Communication and Information Sciences
O College of Community Health Sciences
O College of Education
O College of Engineering
O College of Human Environmental Sciences
O Capstone College of Nursing
O School of Social Work
O Undecided

Experience using the World Wide Web:

O Novice: I am not familiar with using the World Wide Web
O Intermediate: I am familiar with using the World Wide Web
O Proficient: I am at ease with using the World Wide Web

Number of courses previously taken that used Web-based lessons:

O None O 1 O 2 O 3 O 4 or more

(STUDENT SATISFACTION QUESTIONNAIRE, continued)

Please read the statements below. Click in the circle by each statement that, for the most part, describes yourself. Answer each question as honestly as you can.

	Often	Sometimes	Seldom
1. I am able to access a computer with an Internet connection to do my work for this class.	O	O	O
2. The resources I need for the Web lessons are readily available through the Internet.	O	O	O
3. I am satisfied with the degree of contact I have with my teacher when working through Web-based lessons.	O	O	O
4. I am pleased with the success I am having with completing the Web-based lessons.	O	O	O
5. My technology knowledge level is sufficient for learning in a Web-based environment.	O	O	O
6. I am feeling somewhat isolated from the University setting by taking a class that places emphasis on learning through Web-based lessons.	O	O	O
7. I would prefer to take more of my classes through Internet delivery.	O	O	O
8. Participating in a Web-based class has allowed me more flexibility in my daily activities.	O	O	O
9. I would prefer more of the course materials in my traditional face-to-face classes to be in a Web-based format.	O	O	O
10. I believe that working in a Web instructional environment enables me to take a more active role in the learning process.	O	O	O
11. Communication with other students through email is a positive experience.	O	O	O
12. I find the online tutorials to be useful in helping me understand the material.	O	O	O
13. My Web-based class is providing me with skills that I can use in other courses.	O	O	O
14. I believe that the Web instructional environment is preparing me for technology use in my profession.	O	O	O
	Yes	No	
15. I would be willing to take a Web-based course again.	O	O	
16. I would recommend a Web-based course to a friend.	O	O	

Thank you. Please click the Submit button below. You will be linked to a form to submit in order for you to receive two bonus percentage points added to your final course grade.

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